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PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in or relating to the Production of Floorings or other Strong Set Masses from Water-setting Cementitious Materials

We, VICTOR LEEFEBURE, of Imperial Chemical House, Millbank, London, S.W.1, and JOSEPH JOHN ETRIDGE and FRANCIS ROBERT HIMSWORDTH, both of Norton Hall, The Green, Norton-on-Tees, County Durham, all British subjects, and IMPERIAL CHEMICAL INDUSTRIES LIMITED, of Imperial Chemical House, Millbank, London, S.W.1, a British Company, do hereby declare the nature of this invention to be as follows:—

This invention relates to the production from water-setting cementitious compositions of floorings or other strong set masses having hard decorative wear resisting surfaces such, for example, as coves, skirtings, walls up to dado height and surface fittings of the nature of larder shelves, table tops.

In the production of set masses or articles of the kind described it has been customary hitherto to employ Portland cement or magnesium oxychloride cements. They have well recognised disadvantages. Portland cement moulded products and trowelled screeds shrink with disfigurement by cracking or crazing of decorative surfaces. Magnesium oxychloride cements are subject to shrinkage and other kinds of volume change and are seriously corrosive in relation to pipes and reinforcements. Moreover, in order to avoid the above mentioned defects, it is necessary to use relatively coarse aggregate, and consequently the highly decorative effects obtained through the use of small aggregate are lost.

Attempts have been made in the past to produce such hard set masses by using quick setting binders, for example, plaster of Paris, having incorporated therein various fillers, but although these compositions possess the advantages of quick setting, improved trowelling qualities, non-corrosiveness and freedom in the set mass from cracking and crazing, success has not attended these efforts, because the set products lack the necessary strength, hardness and resistance to wear. Some what more successful attempts have been

made to produce such masses by using compositions of the type mentioned in British Patent 451,113 comprising a catalysed anhydrite plaster binder and aggregate formed to set anhydrite plaster, but even these products do not possess the requisite strength, toughness, and wear resistance for certain purposes. Similar remarks apply to the use of catalysed anhydrite plasters when used alone.

We have found that strong set masses with strength and wear resistance approaching those of set cement and which are non-corrosive, do not crack or craze, and are substantially free from volume change, can be produced from compositions comprising a mixture of catalysed anhydrite plaster and an aggregate consisting of crushed rock anhydrite or gypsum with or without added pigment. These mixes possess the advantage over cement mixes that almost any tint may, owing to the comparative whiteness of the plaster, be produced by blending with a suitable pigment. The improved strength and wear resistance of the set masses, which are important features of the invention, are attributed to the use of the special anhydrite or gypsum aggregates, which both give excellent bond with the anhydrite binder as described below.

As the anhydrite binder we may use any type of catalysed anhydrous calcium sulphate plaster, but we prefer to use catalysed mineral anhydrite plasters of the kinds described in British Patents, 236,695, 317,672, 459,134, and Application No. 3814/42 (Serial No. 554,952).

The grading of the aggregate and the relative proportions of aggregate and binder may be varied to suit that particular product being made and the properties required in it. Thus for thick slabs, e.g. blocks and walls, in which high strength is required, relatively coarse aggregate may be used. It might be thought that the use of such coarse aggregate would yield set masses having internal surfaces of weakness at the

boundaries between the aggregate and the set binder. Actually the bond between the aggregate and the binder is exceptionally good apparently due to chemical interaction between the catalysed anhydrite binder and the chemically similar aggregate. On the other hand we have found that this same chemical reactivity of the rock aggregate limits the size of aggregate that can be used to material not less than B.S.S. 52. Finer material than this tends to react with the catalysts in the binder and to interfere with the set of the latter. The proportions of aggregate and binder which are herein referred to by volume may be varied to suit the type of product and the method of forming it, always provided that there is a sufficient proportion of binder. We have found that for these general purposes the proportion of aggregate may be varied between 2% and 70% and that the proportion of binder should not be less than 30%. Hence for cast and moulded objects we use a composition comprising from 2% to 70% of crushed rock anhydrite or crushed rock gypsum aggregate including no material finer than B.S.S. 52. We have also found that in the production by trowelling of floorings, table tops or other set masses in which a good finished surface is required, the proportions and grading of the aggregate must be controlled within much narrower limits as hereinafter described if the compositions are to give successful results.

In carrying out the invention the ingredients of the compositions may either be premixed in the dry state or they may be mixed as required. When a comparatively fine aggregate it being used the former method is often preferable. It possesses the advantages that the ingredients are uniformly mixed in the correct proportions to give the most wear resistant product and that the operator needs only to gauge the composition with the correct water quantity. Premixed compositions are prepared by thoroughly mixing graded crushed gypsum or anhydrite with prepared catalysed plaster, and pigment if the binder is to be a coloured one, in a mixer which has no grinding members. Such premixed compositions are prepared for the casting or trowelling process simply by mixing with the necessary quantity of water. On the other hand when coarse aggregate is used it is best to mix the ingredients at the place where the composition is to be used. This can be readily done in any kind of concrete mixer, for example, a Winnet mixer. The aggregate and plaster may be mixed dry and the water then added, or all three ingredients may be mixed together, but it is

best to introduce the aggregate during the wet mixing operation.

As already mentioned the invention finds a particularly valuable application in the production of flooring. Floors of set cementitious material are most frequently produced by the successive steps of laying the gauged composition on to a suitable backing or foundation, then screeding, floating, and trowelling as in normal practice. The set surface is generally finished when sufficiently dry by abrading either by hand or mechanically. We have found that if the mixed composition is to be suitable for this purpose the grading of the aggregate must be between B.S.S. 48 and 52. The use of material coarser than this adversely affects the trowelling operation and does not yield such a well closed surface; also there is a tendency for the coarse particles to be pulled out of the surface under the action of the trowel. As already mentioned, finer material than this tends to be reactive and interfere with the normal setting of the binder. When the surface of the set composition is to be finished by sanding we have found that it is preferable to use an aggregate graded between B.S.S. 10 and 36 because it gives a more pleasing decorative effect and because it cuts better under the disc.

We have also found that in compositions for use in flooring the ratio of the proportion of aggregate to binder should lie between the limits 40:60 and 60:40 and should preferably be 50:50, the parts being by volume. With less than 40% by volume of aggregate the surface tends to be less wear resisting, whilst when more than 60% is used the gauged mix becomes difficult to work and there is consequent danger of air pockets, porosity and poor adhesion being found in the finished product.

In mixes for flooring, we therefore prefer to use compositions comprising mixtures of from 40 to 60 parts by volume of anhydrite binder and from 60 to 40 parts by volume of aggregate graded between B.S.S. 48 and 52, and in particular a 50:50 mixture of these ingredients. If the surfaces are to be subsequently finished by abrading, we prefer to use an aggregate graded between B.S.S. 10 and 52. The water used for gauging will be about 15% by volume of the mixed aggregate and binder.

The use of these crushed rock anhydrite and gypsum aggregate in flooring mixes made from anhydrite binders is believed to have a number of advantages over anhydrite compositions used alone or in combination with sand or the like. Firstly, a chemical bond appears to be 130

formed between the aggregate and the setting binder, which results in a set mass possessing great cohesive strength. Then a slab made from the preferred composition, comprising 50% catalysed anhydrite plaster and 50% crushed rock anhydrite graded between B.S.S. $\frac{1}{8}$ " and $\frac{3}{16}$ ", broke in the set binder and through the grains of aggregate when the slab was violently fractured, which indicates that the coherance of the set mass was so good that the aggregate broke before it could be pulled out of its matrix. Again, the new flooring possesses greatly improved wear resistance which is conferred upon it by the aggregate. The mechanism of wear appears to be that the aggregate, being the harder material, tends to stand slightly proud and to take most of the wear. It would be expected that in such circumstances there would be a tendency for the aggregate to come increasingly into relief and thus to become liable to removal from the matrix. However, these aggregates appear to possess the great advantages that the strong chemical bond before referred to prevents this and that the difference in the relative hardness of the aggregate and the matrix is comparatively small, and consequently the aggregate itself very gradually wears away and is never thrown into such relief that it tends to pull from the latter. These same properties are also of great value when the surface is subsequently to be sanded or cut with an abrasive disc. The good bond between the aggregate and the binder prevents the former from pulling out and the aggregate, although harder than the set binder, is readily abraded by the disc to give a final finished surface which is smooth and level.

In laying a floor according to the invention we may employ a layer of open mesh hessian to a backing by means of an adhesive composition of the kind described in British Patent Specification No. 524,928, and then screed on the composition and tamp, float and trowel. The wet floor is then allowed to set, during which time it may be covered to prevent too rapid evaporation of water. When the surface is sufficiently hard, generally after 7 days,

it is abraded by hand or by means of a suitable sanding machine and is finally given a liquid finishing treatment to bring up the colour and to confer extra water resistance. This may be effected by any of the usual media employed to reduce absorption and improve surface appearance in such moulded or trowelled surfaces, as for example wax or oil media. Of these we prefer to use drying oil media with or without an added thinner such as white spirit. We find that special resistance is imparted by using oil modified synthetic resin media, especially a solution of a tung-oil-modified phenol formaldehyde resin in white spirit.

Similar finishing treatments may also be applied to cast, moulded or otherwise formed set masses or articles produced from the compositions of the invention.

For certain uses various fillers, such as wood, sawdust, cork or asbestos fibre may be incorporated in the dry compositions or may be introduced during the operation of gauging with water. They usually, however, reduce the strength and hardness of the set composition. When fillers of these kinds are used we prefer to employ those of low water absorption and low wetting characteristics, as for example asbestos fibre, cork or hardwood.

Whilst the methods we have described above give good results and yield products suitable for general purposes, we have found that improved strength and hardness and reduced absorptive properties in the finished article can be obtained by wetting the set or setting mass with water or aqueous solutions of salts which catalyse the set of anhydrite, for example aluminium sulphate. The method of applying this additional treatment will vary with the size and nature of the set mass to be treated: thus portable articles can be immersed in the treating liquid whilst larger areas may be brushed with it and then covered, or may have applied to them a layer of sawdust which has been wetted with the treating liquid.

Dated the 31st day of May, 1943.

J. W. RIOSDALE,
Solicitor for the Applicants.

COMPLETE SPECIFICATION

Improvements in or relating to the Production of Floorings or other Strong Set Masses from Water-setting Cementitious

Materials

We, VICTOR LEEFEBURG, of Imperial Chemical House, Millbank, London, 10¹ S.W.1, and JOSEPH JOHN FRIDGE and FRANCIS ROBERT HINSMWORTH, both of

Norton Hall, The Green, Norton-on-Tees, County Durham, all British subjects, and IMPERIAL CHEMICAL INDUSTRIES LIMITED, of Imperial Chemical House, Millbank, 110

London, S.W.1, a British Company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the production from water-setting cementitious compositions of floorings or other strong set masses having hard decorative wear resisting surfaces such, for example, as coves, skirtings, walls up to dado height and surface filigets of the nature of larger shelves, table tops.

In the production of set masses or articles of the kind described it has been customary hitherto to employ Portland cement or magnesium oxychloride cement. They have well recognised disadvantages. Portland cement moulded products and trowelled screeds shrink with disfigurement by cracking or crazing of decorative surfaces. Magnesium oxychloride cements are subject to shrinkage and other kinds of volume change. In order to avoid the above mentioned defects, it is necessary to use relatively coarse aggregate, and consequently the highly decorative effects obtained through the use of small aggregate are lost. Furthermore magnesium oxychloride cements are corrosive in relation to pipes and reinforcement.

Attempts have been made in the past to produce such hard set masses by using quick setting binders, for example, plaster of Paris, having incorporated therein various fillers, but although these compositions possess the advantages of quick setting, improved trowelling qualities, non-corrosiveness and freedom in the set mass from cracking and crazing, success has not attended these efforts, because the set products lack the necessary strength, hardness and resistance to wear. Some- what more successful attempts have been made to produce such masses by using compositions of the type mentioned in British Specification 451,113 comprising a catalysed anhydrite plaster binder and aggregate formed of set anhydrite plaster, but even these products do not possess the requisite strength, toughness, and wear resistance for certain purposes. Similar remarks apply to the use of catalysed anhydrite plasters when used alone.

In British Specification 521,997 there are disclosed, for use in situations where high temperatures may be experienced, calcium sulphate plasters or cements, to which has been added at least 20 per cent. of aggregate comprising crushed rock anhydrite, crushed limestone or crushed rock gypsum, the grading of said aggregate being such that it passes British Standard Sieve 10 and is retained on

British Standard Sieve 72. In contrast with this we have now found that it is necessary for the production of strong set masses of the type now described to employ mixtures of accelerated anhydrite and an aggregate consisting of crushed rock anhydrite or gypsum graded so that none passes British Standard Sieve 52 and 75% by weight is retained on British Standard Sieve 25.

According to the present invention therefore, strong set masses with strength and wear resistance approaching those of set cement are produced by setting a mixture of from 80 to 90% by volume of finely ground anhydrous calcium sulphate and from 40 to 70% by volume of an aggregate consisting of crushed rock anhydrite or gypsum graded so that none passes British Standard Sieve 52 and not less than 75% by weight is retained on British Standard Sieve 25, in the presence of water and of a catalyst for accelerating the set of the anhydrous calcium sulphate. The catalyst may comprise one or more components selected from the following: sulphates and acid sulphates of alkali metals and ammonium, cupric sulphate, zinc sulphate, ferrous sulphate, aluminium sulphate, ferric sulphate, and their double sulphates, e.g. the alums. Preferably the catalyst is selected from the sulphates of zinc, potassium and aluminium. The binder is of plaster fineness. A suitable grading is 80% passing British Standard Sieve 172.

The set masses produced in this way are non-corrosive, do not crack or craze and are substantially free from volume change. These mixes possess the advantage over cement mixes that almost any tint may, owing to the comparative whiteness of the plaster, be produced by blending with a suitable pigment. The improved strength and wear resistance of the set masses, which are important features of the invention, are attributed to the use of the special anhydrite or gypsum aggregates, which both give excellent bond with the anhydrite binder as described below. The catalyst is preferably premixed with the calcium sulphate to give a binder of controlled properties, but it may alternatively be introduced in the gauging water.

As the anhydrite binder we may use any type of catalysed anhydrous calcium sulphate plaster, but we prefer to use catalysed mineral anhydrite plasters of the kinds described in British Specifications 236,695, 317,672, 459,134 and 554,952.

The grading of the aggregate and the relative proportions of aggregate and binder may be varied to suit that particular product being made and the properties required in it. Thus for thick 130

slabs, e.g. blocks and walls, in which high strength is required, relatively coarse aggregate may be used. It might be thought that the use of such coarse aggregate would yield set masses having internal surfaces of weakness at the boundaries between the aggregate and set binder. Actually the bond between the aggregate and the binder is exceptionally good, apparently due to chemical interaction between the catalysed anhydrite binder and the chemically similar aggregate. On the other hand we have found that this same chemical reactivity of the rock aggregate limits the size of aggregate that can be used to material not less than British Standard Sieve. The British Standard Sieves are those referred to in "British Standard Specification for test sieves" No. 410-1943. Finer material than this tends to react with the catalysts in the binder and to interfere with the set of the latter. The proportions of aggregate and binder which are herein referred to by volume may be varied to suit the type of product and the method of forming it, always provided that there is a sufficient proportion of binder. We have found that for these general purposes the proportion of aggregate may be varied between 40% and 70% and that the proportion of binder should not be less than 30%. Hence for cast and moulded objects we use a composition comprising from 40% to 70% of crushed rock anhydrite or crushed rock gypsum aggregate including no material finer than British Standard Sieve 62. We have also found that in the production of trowelling floorings, table tops or other set masses in which a good finished surface is required, the proportions and grading of the aggregate must be controlled within much narrower limits as hereinafter described if the compositions are to give successful results. Reinforcement, for example, metal reinforcement, may be employed if desired.

In carrying out the invention the ingredients of the composition may either be premixed with the dry state or they may be mixed as required. When a comparatively fine aggregate is being used the former method is often preferable. It possesses the advantages that the ingredients are uniformly mixed in the correct proportions to give the most wear resistant product and that the operator needs only to gauge in composition with the correct water quantity. Premixed compositions are prepared by thoroughly mixing graded crushed gypsum or anhydrite with prepared catalysed plaster, and pigment if the binder is to be a coloured one, in a mixer which has no grinding members. Such premixed com-

positions are prepared by the casting or trowelling process simply by mixing with the necessary quantity of water. On the other hand when coarse aggregate is used it is best to mix the ingredients at the place where the composition is to be used. This can be readily done in any kind of concrete mixer, for example a Winget mixer. The aggregate and plaster may be mixed dry and the water then added, or all three ingredients may be mixed together, but it is best to introduce the aggregate during the wet mixing operation.

As already mentioned the invention finds a particularly valuable application in the production of flooring. Floors of set cementitious material are most frequently produced by the successive steps of laying the gauged composition on to a suitable backing or foundation, then screeding, floating and trowelling as in normal practice. The set surface is generally finished when sufficiently dry by abrading either by hand or mechanically. We have found that if the mixed composition is to be suitable for this purpose the grading of the aggregate must be between British Standard Sieves 4" and 62. The use of material coarser than this adversely affects the trowelling operation and does not yield such a well closed surface; also there is a tendency for the coarse particles to be pulled out of the surface under the action of the trowel. As already mentioned, finer material than this tends to be reactive and interfere with the normal setting of the binder. When the surface of the set composition is to be finished by sanding we have found that it is preferable to use an aggregate graded between British Standard Sieves 10 and 30 because it gives a more pleasing decorative effect and because it cuts better under the disc.

We have also found that in compositions for use in flooring the ratio of the proportion of aggregate to binder should lie between the limits 40:80 and 60:40 and should preferably be 50:50, the parts being by volume. With less than 40% by volume of aggregate the surface tends to be less wear resisting, whilst when more than 60% is used the gauged mix becomes difficult to work and there is consequent danger of air pockets, porosity and poor adhesion being found in the finished product.

In mixes for flooring, we therefore prefer to use compositions comprising mixture of from 40 to 60 parts by volume of anhydrite binder and from 60 to 40 parts by volume of aggregate graded between British Standard Sieves 4" and 62, and in particular a 50:50 mixture of these ingredients. If the surfaces are to be subse-

quently finished by abrading, we prefer to use an aggregate graded between British Standard Sieves 10 and 36. The bulk density of this aggregate is approximately 1.4 times that of catalysed anhydrite plaster. The water used for gauging will be about 15% by volume of the mixed aggregate and binder.

The use of these crushed rock anhydrite and gypsum aggregates in flooring mixes made from anhydrite binders is believed to have a number of advantages over anhydrite compositions used alone or in combination with sand or the like. Firstly, a chemical bond appears to be formed between the aggregate and the setting binder, which results in a set mass possessing great cohesive strength. Thus, a slab made from the preferred composition, comprising 50% catalysed anhydrite plaster and 50% crushed rock anhydrite graded between British Standard Sieves $\frac{1}{8}$ " and 36, broke in the set binder and through the grains of aggregate when the slab was violently fractured, which indicates that the adherence of the set mass was so good that the aggregate mass broke before it could be pulled out of its matrix. Again, the new flooring possesses greatly improved wear resistance which is conferred upon it by the aggregate. The mechanism of wear appears to be that the aggregate, being the harder material, tends to stand slightly proud and to take most of the wear. It would be expected that in such circumstances there would be a tendency for the aggregate to come increasingly into relief and thus to become liable to removal from the matrix. However, these aggregates appear to possess the great advantages that the strong bond before referred to prevents this and that the difference in the relative hardness of the aggregate and the matrix is comparatively small, and consequently the aggregate itself very gradually wears away and is never thrown into such relief that it tends to pull from the latter. These same properties are also of great value when the surface is subsequently to be sanded or cut with an abrasive disc. The good bond between the aggregate and the binder prevents the former from pulling out and the aggregate, although harder than the set binder, is readily abraded by the disc to give a final finished surface which is smooth and level.

In laying a floor according to the invention we may apply a layer of open mesh hessian to a backing by means of an adhesive composition of the kind described in British Patent Specification No. 524,928, and then screed on the composition and tamp, float and trowel. The wet floor is then allowed to set, during which

time it may be covered to prevent too rapid evaporation of water. When the surface is sufficiently hard, generally after 7 days, it is abraded by hand or by means of a suitable handing machine and is finally given a liquid finishing treatment to bring up the colour and to confer extra water resistance. This may be effected by any of the usual media employed to reduce absorption and improve surface appearance in such moulded or trowelled surfaces, as for example wax or oil media. Of these we prefer to use drying oil media with or without an added thinner such as white spirit. We find that special resistance is imparted by using oil modified synthetic resin media, especially a solution of tung-oil-modified phenol formaldehyde resin in white spirit.

Similar finishing treatments may also be applied to cast, moulded or otherwise formed set masses or articles produced from the compositions of the invention.

For certain uses various fillers, such as wood, sawdust, cork or asbestos fibre may be incorporated in the dry compositions and may be introduced during the operation of gauging with water. They usually, however, reduce the strength and hardness of the set composition. When fillers of these kinds are used we prefer to employ those of low water absorption and low wetting characteristics, as for example asbestos fibre, cork or hardwood. Organic fillers improve the heat and sound insulating properties of the set masses but tend to cause movement under damp conditions, and to reduce wear resistance. The proportion should therefore be limited to not more than 10% of the sum of the volumes of the aggregate and binder.

Whilst the methods we have described above give good results and yield products suited for general purposes, we have found that improved strength and hardness and reduced absorptive properties in the finished article can be obtained by wetting the set or setting mass with water or aqueous solutions of salts which catalyse the set of anhydrite, for example aluminium sulphate. The method of applying this additional treatment will vary with the size and nature of the set mass to be treated; thus portable articles can be immersed in the treating liquid whilst larger areas may be brushed with it and then covered, or may have applied to them a layer of sawdust which has been wetted with the treating liquid.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of producing strong set

- masses with strength and wear resistance approaching those of set cement which comprises setting a mixture of from 60 to 30% by volume of finely ground anhydrous calcium sulphate and from 40 to 70% by volume of an aggregate, consisting of crushed rock anhydrite or gypsum graded so that none passes British Standard Sieve 52 and not less than 75% by weight is retained on British Standard Sieve 25, in the presence of water and a catalyst for accelerating the set of the anhydrous calcium sulphate.
2. A method as claimed in Claim 1 in which the catalyst is premixed with the anhydrous calcium sulphate.
3. A method of producing floors, coves, table tops, shelves, and like furnishings as claimed in Claim 2, characterised by the feature that the grading of the aggregate is between British Standard Sieves 75 and 52.
4. A method of producing floors, coves, table tops, shelves and like furnishings, as claimed in Claim 2, characterised by the features that the grading of the aggregate is between British Standard Sieves 10 and 36 and the surface is subsequently finished by abrading.
5. A method as claimed in Claims 3 and 4 in which the relative proportions by volume of anhydrous calcium sulphate plaster and aggregate are from 60% to 40% and from 40% to 60% respectively.
6. A method as claimed in Claims 2 and 3 in which the wet mix is finished by trowelling.
7. A method as claimed in any of the preceding claims according to which the set or setting mass is wetted with water or with an aqueous solution of a salt which catalyses the set of anhydrous calcium sulphate.
8. A method as claimed in Claims 3 and 4 in which a layer of backing, particularly open mesh hessian, is bonded to a foundation by means of an adhesive composition and the gauged mixture is then applied to the backing.
9. A method as claimed in any of the preceding claims in which the surface of the set mass after drying sufficiently is treated with a drying oil or a drying oil thinned with white spirit.
10. A method as claimed in any of the preceding claims in which the surface after hardening and drying sufficiently is treated with a tung-oil-modified phenol formaldehyde resin dissolved in white spirit.
11. Set masses made according to Claims 1, 2 and 7.
12. Floors, coves, table tops, shelves and like furnishings made according to Claims 3, 4, 5 and 6.
13. Articles made according to Claims 8, 9 and 10.
14. A composition for use according to Claims 2 and 3 comprising from 60% to 40% of catalysed anhydrite plaster and from 40% to 60% by volume of rock anhydrite or rock gypsum aggregate graded so that it all passes British Standard Sieve 75, not less than 75% by weight is retained on British Standard Sieve 25 and all is retained on British Standard Sieve 52.
15. A composition suitable for use according to Claims 2 and 4 comprising from 60% to 40% of catalysed anhydrite plaster and from 40% to 60% by volume of rock anhydrite or rock gypsum aggregate graded so that it all passes British Standard Sieve 10, not less than 75% by weight is retained on British Standard Sieve 25, and all is retained on British Standard Sieve 36.

Dated the 30th day of May, 1944.

J. W. RUSDALE,
Solicitor for the Applicants.